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BIRCH STEWART KOLASCH & BIRCH
PO BOX 747
FALLS CHURCH, VA 22040-0747

EXAMINER	
SULTANA, NAHIDA	

ART UNIT	PAPER NUMBER
1791	

NOTIFICATION DATE	DELIVERY MODE
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

mailroom@bskb.com

Office Action Summary	Application No.	Applicant(s)	
	10/566,476	MURATA ET AL.	
	Examiner	Art Unit	
	NAHIDA SULTANA	1791	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 October 2009*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,3-24 and 32-36* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,3-24 and 32-36* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *09 October 2009* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *12/07/2009*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. This final action is in response to the amendment received on 10/09/2009, for the first non-final office action sent on 07/09/2009.

Claim Objections

2. Claim 1 is objected to because of the following informalities: The amended claim 1 uses poor language such as "arranging a substrate close to a tip of the nozzle to be close to a substrate." Applicant should amend this to -- arranging the tip of the nozzle to be close to the substrate -- . Appropriate correction is required.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claim 1 and its dependents are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The amended claim limitation teaches: "droplet being dried during flight to be a solidified substance at landing on the substrate," however this limitation is not fully described in the specification. Applicant failed to show the droplet is dried during the flight to be solidified substance at landing on the substrate. The previous version of claim 1, specifically mentioned "solidifying the

droplet after the fluid droplet is landed on the substrate" and this is shown in the specification (see page 7. lines 1-2, substrate temperature use for drying landed droplet, page 19. lines 15-25). Applicant also mention controlling the pressure and temperature of the solvent in the atmosphere (page 20. lines 1-5), however, does not actually disclose having droplet being dried during flight to be solidified substance at landing on the substrate.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 1, 32, 35, and 36 are rejected under 35 U.S.C. 102(b) as being anticipated by Uchiyama et al. (US Patent 4, 897, 667).

For claims 1, 32, 35, 36, Uchiyama et al. teach:

A method of producing a three-dimensional structure ("recording medium" abstract), comprising the steps of: providing a needle-shaped nozzle body having a fine inside diameter at a tip thereof (Fig. 1. item 20-nozzle, col. 4. lines 5-10), the nozzle supplied with a fluid material (Fig. 1. where nozzle# 20 connect to ink tank #23, also see col. 10-12) ; arranging a substrate close to a tip the nozzle to be close to a substrate (Fig. 1. 20-nozzle, and 37-recording paper/substrate); ejecting a fluid droplet having an

ultra-fine diameter from the tip of the nozzle toward a surface of the substrate by applying a voltage having a prescribed pulse waveform to the needle-shaped nozzle body via the electrode so as to make the droplet fly and land on the substrate ("inside the nozzle 20, a charging electrode 27 provided with a hole communicating with the orifice is disposed. By the electrode 27, the ink droplets 26 are charged based on a modulated image signal" col. 4. lines 20-30), and thus it is inherent that some of the droplet are being dried during flight to be solidified substance at landing on the substrate due to the electric field provided by electrode (Fig. 1. item 27-electrode); and continually ejecting subsequent droplets by applying the prescribed pulse voltage to the nozzle (Fig. 1. item 26# droplets), and thus it is inherent that droplets are being stacked on said solidified substance so as to form an image on a recording paper (col. 2. lines 45-50).

Uchiyama et al. also teach having wherein the nozzle inside diameter is 0.01 to 15 micrometer ("10 micron" col. 4. lines 5-10); wherein the needle-shaped nozzle is a micro capillary tube (col. 4. lines 5-10); further comprising an electrode within the nozzle (col. 4. lines 20-25), for the benefit of controlling the landing of the droplet (col. 1. lines 15-22).

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. Claims 1, 3-6, 8-13, 23-24, and 35 are rejected under 35 U.S. C. 103(a) as being unpatentable over Danforth et al. (US patent No. 5, 997, 795) in view of Sachs et al. (US Patent No. 5, 807, 437).

For claims 1, 3 and 35, Danforth et al. teach:

A method of producing a three-dimensional structure ("process for forming photonic bandgap structures" abstract), comprising the steps of: providing a nozzle having interchangeable size and shape of the dispensing head outlet using various orifice sizes and shapes, or interchangeable orifice inserts in the tip of the nozzle (col. 10. lines 30-40); arranging a substrate close to a tip of fluid-ejection body (example Fig. 3. Items 14 ("print head"), 19 ("substrate")), having a desired diameter ("nozzle sizes" col. 10. lines 30-40), supplied with a solution ("material" Col. 6. lines 15-40); ejecting a fluid having smaller diameter toward a surface of the substrate (col. 6. lines 60-65), making the fluid land on the substrate (example fig. 3, Item 100); and solidifying the droplet after the fluid droplet is landed on the substrate (Col. 11. lines 40-60).

However, Danforth et al. do not teach: diameter of the nozzle is ultrafine; applying a voltage having a prescribed waveform to the needle-shaped fluid-ejection body; wherein the electric line of force is attracted to top of solidified substance of the droplet, and wherein the three dimensional structure is grown by stacking the subsequent flying droplet guided along electric line of force onto the top of the solidified substance.; wherein the needle-shaped nozzle is a micro-capillary tube.

In the same field of endeavor, three dimensional printing system, Sachs et al. teach: ejecting a fluid droplet having an ultra-fine diameter from the tip of the nozzle toward a surface of the substrate (col. 4. lines 50-55), applying a voltage having a prescribed waveform to the needle-shaped fluid-ejection body ("voltage applied to charging cells" Col. 4. lines 10-25), forming three dimensional printing pattern (example Fig. 1 & 2, col. 3. lines 25-40), wherein the electric line of force is attracted to top of solidified substance of the droplet (col. 4. lines 40-50), and wherein the three dimensional structure is grown by stacking the subsequent flying droplet guided along electric line of force onto the top of the solidified substance ("controlling the voltage at the moment of break-off allows for control of the landing position of the droplet at target 30" col. 4. lines 33-45); wherein the needle-shaped nozzle is a micro-capillary tube (col. 4. lines 60-65).

It would have been obvious to one ordinary skill in the art at the time of the applicant's invention to modify the process of making three dimensional structure as taught in Danforth et al. with having electrostatic charge applied to the fluid, as taught in Sachs et al., for the benefit of controlling the landing position of the droplet at a target position (Col. 4. lines 40-50).

Furthermore, since it is inherent the droplet are somewhat dried during the flight to be solidified since Danforth et al. teach having similar material and solvent: ("particular material may be selected from the group consisting of ceramic materials, elemental metals, metal alloys..." col. 6. Lines 25-40, Col. 8. lines 20-35, "size of the largest particles in the distribution should be substantially smaller than the diameter of

the dispensing nozzle" col. 6. Lines 60-65), and the three-dimensional structure is controlled by a volatile property of the droplet ejected from the needle-shaped fluid-ejection body (col. 6. lines 43-50).

For claim 4, Danforth et al. further teach having similar material and solvent: ("particular material may be selected from the group consisting of ceramic materials, elemental metals, metal alloys..." col. 6. Lines 25-40, Col. 8. lines 20-35, "size of the largest particles in the distribution should be substantially smaller than the diameter of the dispensing nozzle" col. 6. lines 60-6), and the three-dimensional structure is controlled by a volatile property of the droplet ejected from the needle-shaped fluid-ejection body ("material" col. 6. lines 25-40; "material dispersed is adheres to the previous layer" col. 12. lines 25-30).

For claim 5, Danforth et al. teach wherein a temperature of the substrate is controlled in that the previously landed droplet on the substrate is volatilized to be hard enough for the subsequent droplet stacked thereon (col. 10. lines 50-60).

Claim 6, Danforth et al. further teach: wherein a surface temperature of the substrate is controlled by at least one heating means selected from the group consisting of a Peltier element, an electric heater, an infrared heater, a heater using fluid such as an oil heater, a silicon rubber heater, and a thermistor, that is fixed to the substrate or a substrate supporting body ("voltage current applied to heat substrate" Col. 10. lines 55-60).

Regarding Claim 8, 9, 10, and 11, Danforth et al. further teach: wherein the fluid is a solution containing metal particulates (Col 6. lines 25-40), wherein the fluid is a

polymer solution (Col. 7. lines 35-50, col. 8. lines 20-35), wherein the fluid is a solution containing ultra-fine ceramic particles ("ceramic" and "size of particles" col. 6, lines 25-40 & 60-67), fluid is sol-gel of ceramic ("ceramic" Col. 6. lines 25-40 & 60-67).

For claims 12-13, Danforth et al. further teach: wherein the fluid is a fluid containing at least one solution selected from the group consisting of a solution containing metal particulates, a polymer solution, a solution containing ultra-fine ceramic particles, a sol-gel solution of ceramics, and a low-molecular weight compound solution (Col. 6. lines 25-40).

For claims 23-24, Danforth et al. further teach: wherein the dielectric constant of the fluid to be ejected is 1 or more ("low dielectric material" Col. 2. lines 1-5), and wherein the steps are conducted in an atmosphere having a vapor pressure of the fluid lower than a saturated vapor pressure of the fluid ("holes may be filled with air or vacuum" col. 1. lines 60-67).

8. Claims 7, 14-22, and 32 rejected under 35 U.S.C. 103(a) as being unpatentable over Danforth et al. (US Patent No. 5, 997, 795) in view of Sachs et al. (US Patent No. 5, 807, 437) and in further view of Hayes (US Patent No. 6, 114, 187).

For claim 7, Danforth et al. teach: producing a three dimensional structure, arranging a substrate close to a tip of ejection body (example Fig. 3. Items 14 ("print head"), 19 ("substrate")), however failed to teach: wherein a surface temperature of the substrate is control in a range from room temperature to 100 ^{o}C.

In the same field of endeavor, method for preparing a chip scale package and

product produced by the method, Hayes teaches: wherein a surface temperature of the substrate is controlled in a range of from room temperature to 100 o C (col. 10. lines 10-30).

It would have been obvious to one ordinary skill in the art at the time of the applicant's invention to modify the method of producing three dimensional structure as taught by Danforth et al. and Sachs et al. with having to control substrate temperature at a specific range, as taught in Hayes, for the benefit of solidifying the droplet faster, since substrate temperature affect the freezing of the droplet (col. 10. lines 10-25).

Regarding claims 14-16, Danforth et al. teach distribution of the droplet substantially smaller than the diameter of the dispensing nozzles outlet as to avoid any bridging effect (col. 6. lines 60-65) and nozzle size shape depends on the application of product being made (col. 10. lines 30-40), however fail to teach specifically: wherein a diameter of the ejected droplet is 15 micrometer or less, wherein a diameter of the droplet is 5 micrometer less, wherein a diameter of the droplet is 3 micrometer or less.

In the same field of endeavor, method for preparing a chip scale package and product produced by the method, Hayes teaches: wherein a diameter of ejected droplet is 15 micrometer or less (col. 8. lines 15-25), wherein a diameter of the droplet is 5 micrometer or less (col. 8. lines 15-25), and wherein a diameter of the droplet is 3 micrometer or less (col. 8. lines 15-25).

It would have been obvious to one ordinary skill in the art at the time of the applicant's invention to modify the diameter of the droplet as taught by Danforth et al. with having specific diameter of the droplet, as shown in Hayes for the benefit of having

device filled via cone shaped solder column 28 in which the vias act as mold to define the column (col. 8. lines 15-25), and specific use in integrated circuit chip (col. 8. lines 24-27).

For claims 17, 18, and 19, Danforth et al. teach: deposited layer solidify rapidly (col. 12. lubes 40-55). However, Danforth et al. fail to teach specifically: wherein a time required for the droplet to be dried and solidified is 2 seconds or less; wherein the time required for the droplet to be dried and solidified is 1 second or less; wherein the time required for the droplet to be dried and solidified is 0.1 second or less.

In the same field of endeavor, Hayes et al. teach: heating substrate using to about 75 ^{o}C (Col. 5. lines 50-55), for the benefit of freezing the metal alloy which is typically at 220 ^{o}C (col. 5. liens 50-55).

It would have been obvious to one having the ordinary skill in the art at the time of the invention to optimize the substrate temperature, and jetting material temperature as taught in Hayes et al. for the benefit solidifying the droplet at specific amount of time, since it has been held that discovering the optimum value of a result effective variable involves only routine skill in the art. *In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).*

9. Regarding claims 20, 21, 22, 32, Danforth et al. fail to teach: wherein a flying speed of the droplet is 4 m/sec or more; wherein the flying speed is 6 m/sec or more; wherein the flying speed is 10 m/sec of more; wherein the nozzle inside diameter is 0.01 micrometer to 15 micrometer.

In the same field of endeavor, method for preparing a chip scale package and

product produced by the method, Hayes teaches: wherein a flying speed of the droplet is 3 m/sec (col. 10. lines 25-30), and teaches speed of the jetting device is varied with the applied voltage applied to the print-head (col. 5. lines 25-30); wherein the orifice size are 15 micrometer to 90 micrometer for solder (col. 10. lines 49-50).

However, Danforth et al. do not teach having flying speed at 4m/sec or more, or 6 m/sec of more.

It would have been obvious to one having the ordinary skill in the art at the time of the invention to optimize the voltage applied to the print-head (col. 5. lines 25-30) in Hayes for the benefit of getting specific speed of the droplet, since it has been held that discovering the optimum value of a result effective variable involves only routine skill in the art. *In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).*

10. Claims 32, 33, 34, 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Danforth et al. (US Patent No. 5, 997, 795) in view of Sachs et al. (US Patent No. 5, 807, 437) and in further view of Uchiyama et al. (US Patent No. 4, 897, 667).

Regarding claims 32, 33, 34, and 36, Danforth specifically mentioned that various nozzle orifice can be employed (col. 10. lines 30-40) depending on particular application, therefore it would have been obvious to use various nozzle sizes.

However, Danforth and Sach et al. failed to teach: wherein the nozzle inside diameter is 0.01 to 15 micrometer; wherein the nozzle inside diameter is 0.01 to 10

micrometer; wherein the nozzle inside diameter is 0.01 to 8 micrometer; further comprising an electrode within the nozzle.

In the same field of endeavor, ink jet printer in which ink is continuously sprouted through a nozzle and divided into ink droplet, Uchiyama et al. teach having wherein the nozzle inside diameter is 0.01 to 15 micrometer (col. 4. lines 5-10); wherein the nozzle inside diameter is 0.01 to 10 micrometer (col. 4. lines 5-10); further comprising an electrode within the nozzle (col. 4. lines 20-25), for the benefit of controlling the landing of the droplet (col. 1. lines 15-22).

It would have been obvious to one ordinary skill in the art at the time of the applicant's invention to modify the nozzle size of Danforth with having specific nozzle size and also to employ an electrode, as taught in Uchiyama, for the benefit of controlling the landing of the droplet for a particular application (see col. 1. lines 15-22; col. 2. lines 15-20). Furthermore, regarding claim 34, it would have been obvious to use even a smaller nozzle diameter in Danforth, depending on particular application (col. 10. Lines 30-40).

Response to Arguments

Applicant's arguments filed for claims 1, 3-24, and 32-36 have been fully considered but they are not persuasive.

Applicant argued subject matter which has not been claimed such as "the stacking of droplets form a column structure, not the parallel roads disclosed by Danforth."

Examiner's response: the claim broadly reads on Danforth 3D structure produced which is done be stacking particles (col. 6. lines 60-65, see exemplary fig. 3).

Applicant argued: Sach et al. teach voltage applied to the stream of out of the nozzle. Therefore no prior art discloses applying a voltage to the nozzle body.

Examiner's response: Examiner disagrees and would like to direct applicant to Sach et al. (see Fig. 4. item 23-charging cells, 22-stream of liquid, and 21-piezoelectric element). The piezoelectric element contains induced voltage that causes the nozzle to vibrate and produce droplets (col. 4. lines 5-10).

Applicant argued Danforth tech having filaments as compared to droplets.

Examiners response: Examiner disagrees and wants to direct applicant to Danforth et al. reference (col. 6. lines 60-65, col. 10. lines 30-40), which specifically mentions different sized nozzle can be used, thus it inherently means smaller sized nozzle can be used for particular application which can produce desired size particles (col. 10. lines 35-40). Furthermore, examiner had relied on secondary reference to show that a smaller sized nozzle (col. 5. lines 50-55), with a voltage applied fig. 4 & 5), as shown in Sach et al., used for the benefit of better controlling the landing droplets.

Furthermore, the new art applied Uchiyama et al. specifically show that electrode is used within nozzle to produce droplets and controlling the landing of the droplet (see col. 4. lines 20-30, col. 1. 15-22) and thus as shown here, it is well known in art to apply voltage to nozzle head to have desired landing in order to make three dimensional structures.

Also, applicant had changed the claimed subject matter such as "the droplet being dried during the flight to be a solidified substance at landing on the substrate." Examiner believes that there is no embodiment in the specification showing this where droplet are being dried and then stacked. If applicant is controlling the atmosphere of the droplet, to have droplet dried before stacking, it should be explained in the specification appropriately, and how it is done (such as specific temperature, pressure, volatility).

Also, Applicant's argument regarding rejection based on Hasei is overcomed due to claim amendment.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

US Patent # 7, 434, 912 A1 shows nozzle charged by electrode and stacking as in claim 1.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL.** See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the

shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to NAHIDA SULTANA whose telephone number is (571)270-1925. The examiner can normally be reached on Mon- Fri 7:30 Am - 5:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Joseph Del Sole can be reached on 517-272-1130. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

NS

/Joseph S. Del Sole/
Supervisory Patent Examiner, Art Unit 1791